Pseudo-Casimir Effect near Transitions in Confined Liquid Crystals

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In highly restricted liquid crystals order fluctuations contribute an important contribution to the total free energy of the system. In such conditions, fluctuations substantially differ from the ones in the bulk. This effect, which is usually described in terms of fluctuation (pseudo-Casimir) forces, directly affects the stability of the system. The influence is stronger when close to a transition in a confined liquid crystal; relevant fluctuation modes become slow yielding a long-range pseudo-Casimir force. The transition can be either a temperature-induced change in phase or a structural transition in a frustrated system caused by internal and external fields. Frustrated chiral and achiral nematic films where a balance between intrinsic chirality, surface anchoring, and magnetic field yields a particular order are briefly treated [1-3]. Effects in frustrated thin Sm C* layers are described in detail. We point out similarities in the behavior of the resulting disjoining pressure. In particular we are interested in a non-monotonic distance dependence of fluctuation forces and in their pretransitional behavior. Special attention is also paid to the surface anchoring that crucially affects fluctuation forces. Finally, possible experimental detection of the predicted effects in confined chiral nematics and smectics is discussed.

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